Open Sharing Platforms and Affordable Lab Spaces as Drivers of Innovation in Biodesign

Executive Summary

The DIYBio movement facilitates innovation by creating communities of people from different backgrounds, sharing knowledge and expertise through courses and open sharing platforms, and facilitating prototyping in affordable lab spaces. This brief focuses on the influence of these material and immaterial resources on innovation in Biodesign. It looks at designers that work with living materials or take inspiration from the life sciences, with practices such as growing new sustainable materials, crafting accessible scientific tools, or imagining future (bio)technologies. Specific drivers of innovation in Biodesign are knowledge hubs such as educational efforts or open sharing platforms, and affordable lab spaces that provide access to tools as well as potential partnerships. The BioHack Academy is an example of a knowledge hub, functioning as a gateway to Biodesign by way of teaching laboratory skills and facilitating project-based learning. The Biofabforum is an example of an online forum for sharing and discussing research results and protocols within biomaterials. Academies and forums create communities and offer a knowledge base for new biodesigners. However, the process from initial idea to final result involves experimentation and many iterations and thus requires time and extended access to resources such as space, skills and tools. Affordable but well-equiped and well-connected labs therefore play a key role for innovation in Biodesign, an example being OpenCell in London. This leads to a series of recommendations on how to support the infrastructure of lab spaces, programmes and platforms, as well as individuals within DIYBio and biodesign communities.

Introduction: Biohacking and Biodesign

It was possible to observe how Do-it-yourself Biology (DIYBio), also called "biohacking"[1] or, more recently, "community biology", has become a movement. This was demonstrated at the BioFabbing[2] event held in 2017 at CERN in Geneva and the 2017 and 2018 Global Community Bio Summits[3] at MIT MediaLab in Cambridge, Massachusetts, both of which hosted several members of European DIYBio spaces.

DIYBio is a movement fuelled by a distributed network of institutes and individuals, to which over time nodes are added and subtracted (for a database of spaces and projects, see the DIYbiosphere platform, http://sphere.diybio.org/). In 2019, Hackteria, the web platform and open source biological art collection will celebrate its tenth anniversary[4], while over the last years numerous new European DIYBio spaces and networks came into existence.[5] These spaces host communities of people from different backgrounds, making interdisciplinairy exchange possible. Among the DIYBio spaces and their members there are commonalities and differences, some using the spaces as a hobby activity, but others are investing time with a professional motivation. Biodesigners can be considered in the latter category; these are designers that work with living materials or take inspiration from the life sciences, with practices such as growing new sustainable materials, crafting accessible scientific tools, or imagining future (bio)technologies (for a list of literature about biodesign, see the Biodesign Challenge, https://biodesignchallenge.org/faqs#whatisbiodesign). Biomaterials, materials made out of growing matter such as mycelium, are a growing trend, with several hybrid company / DIYBio spaces especially dedicated to them.[6, 7]

The DIYBio movement facilitates innovation in Biodesign in multiple ways, two of which will be discussed: (1) academies, workshops and open sharing platforms that enable the sharing of knowledge and expertise (2) affordable lab spaces that facilitate prototyping and cooperation.

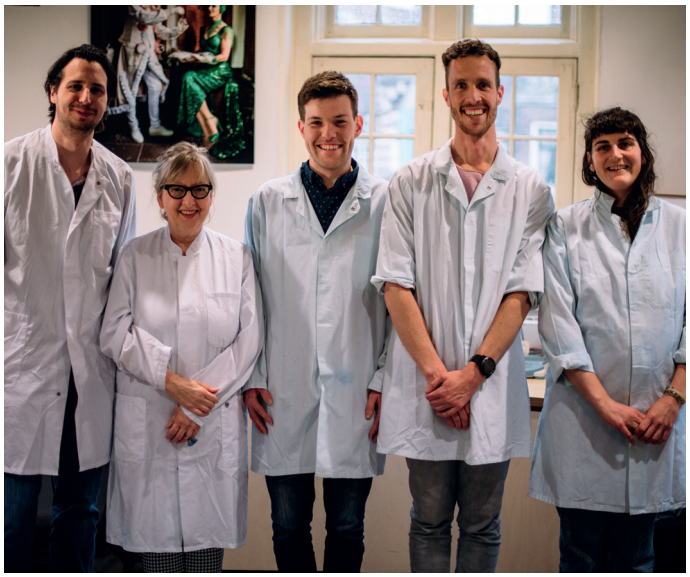
Open Sharing Platforms and Academies

One of the pillars of DIYBio is the open online sharing of experiments, protocols and designs for tools. Within the research domain of biodegradable and bio-based materials such as bioplastics and mycelium materials, online forums such as the Biofabforum[8] promote the open sharing of recipes and experiences.

Online sharing platforms allow people to learn methods, and contribute their own findings, both of which can help in accelerating innovation. The benefit of open sharing is that knowledge is accessible for potentially everyone, and not hidden behind pay-walls. This sharing of knowledge happens outside of academia and industry, and within realms that are accessible to citizens with no prior background in a topic. Moreover, the do-it-yourself and low-cost nature of recipes allows for easy adoption and adaptation. Creating and moderating such platforms takes an effort in time and resources, but with these things in mind their workings should be appreciated.

A set of available DIYBio educational programmes and workshops offer practical skills as well as a project-based learning approach, allowing participants to develop their own research projects and deviate from given protocols. This approach is different from traditional, top-down, educational methods, and fills into the goals of lifelong learning and keeping up with technological developments. An example is the BioHack Academy at Waag's Open Wetlab (Case Study). Other examples include workshops at BioTehna (Ljubljana, Slovenia), MediaLab Prado (Madrid, Spain), and many others.

Coordinating the process of developing these projects, and aiding in the documentation as to make the results open source, is of critical importance to the success of such programmes. The BioHack Academy has grown a community of individuals that have become active in various DIYBio spaces and strong voices in the movement as a whole. Educational programmes in the DIYBio sphere thus also strengthen the growth of the movement and the possibilities for innovation. The open sourcing and sharing of educational methods and tools allow for a broader public to be included in these educational efforts, and serves as an entry into the DIYBio movement. Open source and free platforms enable those outside of academia to be enabled rather than distanced, engaging in a new way of learning and exploring science together.



Students of the BioHack Academy © Waag

Case Study: BioHack Academy

The BioHack Academy is a 10-week programme wherein participants learn about biological techniques, microbiology, genetics, biosafety, and are encouraged to build their own open source laboratory hardware. During the academy, students develop their own research questions, following their own curiosities, varying between practical and critical, applied and artistic.[9] Several biodesign projects have developed beyond the academy programme These include a modular incubator for growing organisms, by designer Candyce Dryburgh[10], Jan-Maarten Luursema's bio-digital slime mold explorations,[11] and Matthijs de Block's endeavours on soft robotics and self-measurement.[12]

Alumni of the academy continue to play a role in DIYBio, a prime example being Chan'nel Vestergaard, who provides educational programmes in S.T.E.A.M. subjects with Littlepinkmaker, and organizes the creative open science space Co-lab in Copenhagen.[13]

Lab Spaces as Infrastructure

Besides DIYBio spaces opening up their doors to the public for workshops or community nights, there is a small but growing number of dedicated professional coworking laboratories that allow affordable space and instrumentation and access to a bigger network of partners for small start-ups and projects within biotechnology and biodesign to develop. La Paillasse[14] in Paris is an early example; a more recent one is Open Cell in London, which provides affordable facilitation for prototyping.[15]

Affordable coworking laboratories not only allow projects and small companies to develop, but also create grounds for developing new ideas into innovations. Low cost lab spaces are founded because they are expected to create a change, creating new possibilities as to who can be included in the developments and work with new (bio) technologies, attracting designers, engineers, scientists and others to solve critical problems, and build tangible results.

The start-up costs related to DIYBio spaces can be a burden, especially with regards to creating the laboratory infrastructure and getting necessary equipment. While sources of funding for projects and networks exist, infrastructural developments are harder to acquire funding. Several labs are housed within universities,[19] or are supported by local municipalities. Some DIYBio spaces resort to crowdfunding campaigns to finance their infrastructure,[20, 21] There is potential to help DIYBio spaces in this development phase. In the urban context space is a crucial issue, in which municipalities can play a role.

Case Study: Open Cell

Open Cell was co-founded by Helene Steiner and Thomas Meany in Shepherd's Bush, London. It consists of a series of self-contained lab spaces, which were built and designed by the Austria-based Biotop collective[16], which demonstrates a cross-border collaboration in Europe.[17] Current residents include Olombria, managing crop pollination by fly species through chemical volatiles, WASE, developing decentralized wastewater treatment systems, and BIOHM, researching and developing circular solutions for the built environment, such as their Triagonomy construction system.[18]

This policy brief sought to elaborate on the potential for innovation in Biodesign through DIYBio platforms, programmes and spaces. Following this brief, a number of recommendations are offered below.

Recommendations

Based on the points discussed above, the following recommendations are made:

1. Support infrastructures that promote innovation in Biodesign, including affordable and accessible lab spaces, and acknowledge that stability for these spaces is vital in establishing a structure to retain expertise and enable further developments of Biodesign projects. Beyond being networking hubs, lab spaces need to be supported to become become creative outlets for bio-based knowledge and business ventures by ensuring support from different sectors.

2. Increase the possibilities of support for open source DIYBio platforms as an effort to grow networked innovation, acknowledging the challenges of open source approaches.

3. Stimulate the transitions between different organizational and financial models of open sharing platforms, biodesign programmes and affordable lab spaces.

4. Encourage or advocate long-term support for DIY biologists and biodesigners beyond prescribed educational programmes, which would allow them to further develop their skills and outputs, including political and organizational skills that enable them to ensure that DIYBio is seen as safe and legitimate.

5. Promote collaboration at all levels, including between groups of people with different backgrounds, and cross-border enterprises.

6. Strive to strike a healthy balance for lab spaces to provide a diverse range of benefits for users: These include teaching basic technical biological skills, fostering an open mind-set for creative projects to flourish, as well as practical advice for potential commercial enterprises.

7. Promote, support and foster cross-country connections and strengthen the sharing of experiences and knowledge between local DIYBio and biodesign communities.

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Colophon

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